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# ETSI EN 301 461 V1.3.1 (2002-11)

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*European Standard (Telecommunications series)*

**Fixed Radio Systems;  
Point-to-point equipment;  
High capacity fixed radio systems carrying SDH  
signals (2 x STM-1) in frequency bands  
with 40 MHz channel spacing and  
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## Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

The present document introduces new classes and grades of equipments focused on applications with single or few channels per links, with or without the XPIC option, suitable for co-polar adjacent channel operation; typical for mobile networks infrastructures.

National transposition dates	
Date of adoption of this EN:	1 November 2002
Date of latest announcement of this EN (doa):	28 February 2003
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 August 2003
Date of withdrawal of any conflicting National Standard (dow):	31 August 2003

# 1 Scope

The present document specifies the minimum performance parameters for a high capacity digital radio-relay system operating in frequency bands with 40 MHz channel spacing in the 4 GHz, 5 GHz, U6 GHz and 11 GHz bands. The channel capacity is 1 x STM 1 on each polarization that allows to transmit up to 2 x STM 1 signals in the same RF channel by using both polarizations in co-channel dual polarized (CCDP) mode of operation with cross-polar interference canceller techniques (XPIC).

The present document is also applicable to 1 x STM-1 ACCP systems operating with co-polar arrangement of 40 MHz for which the CCDP operation with XPIC is considered a non applicable option; for those systems the clauses relevant to XPIC operation (i.e. co-channel "internal" interference) are not applicable. These systems are intended for local high capacity links (e.g. mobile infrastructure connections) where few channels may be used by different operators) and the crowded environment may require co-polar operation on adjacent channels.

Recognizing the benefits from the industrial point of view, two different grades of system have been defined.

- Grade A: based on 30 MHz-like system technology (i.e. based on 128 states modulation) with reduced receiver BER threshold capability.
- Grade B: based on 40 MHz system technology (i.e. based on 64 states modulation) with improved receiver BER threshold capability.

It has to be noted that STM-1 systems can be grouped in order to offer an SDH interface higher than STM-1.

The area of application of these digital radio-relay systems is foreseen to be in trunk and access networks forming part of an SDH-network including optical rings.

Systems considered in the present document shall be able to respect ITU-R and ITU-T performance objectives.

The systems considered should operate in these networks having regard for existing hop length, which are considered to be normally up to about 30 km to 40 km for access and about 60 km for trunk networks, respectively. Hop lengths greater than this latter length are used in special applications.

The systems considered in the present document are intended to allow operation with respect to existing PDH systems using 16 QAM modulation and transmitting 140 Mbit/s applying a channel spacing of 40 MHz.

The parameters specified fall into two categories:

- a) parameters that are required to provide compatibility between channels connected to the same antenna via a multichannel branching system, or channels on the same route connected to separate antennas;

NOTE: Due to the internal functionality of the XPIC, equipment operating on both polarization of the same channel is considered to form a single CCDP system.

- b) parameters defining the transmission quality of the proposed system.

The standardization deals with baseband, IF and RF characteristics relevant to SDH. Antenna/feeder system requirements are also considered for information to the reader, however antenna characteristics are generally covered in EN 300 833 [34].

Baseband interfaces have to be considered for STM-1 signals in accordance with ITU-T Recommendations G.707 [1] and G.957 [2]. PDH interfaces according to ITU-T Recommendation G.703 [3] for signals mapped into STM-1 signals according to ITU-T Recommendation G.707 [1] could be used.

Safety aspects will not be considered in the present document.



## 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] ITU-T Recommendation G.707/Y.1322 (2000): "Network node interface for the synchronous digital hierarchy (SDH)".
- [2] ITU-T Recommendation G.957 (1999): "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".
- [3] ITU-T Recommendation G.703 (2001): "Physical/electrical characteristics of hierarchical digital interfaces".
- [4] CEPT/ERC/REC 12-08: "Harmonised radio frequency channel arrangements and block allocations for low, medium and high capacity systems in the band 3 600 MHz to 4 200 MHz".
- [5] ITU-R Recommendation F.635-6: "Radio-frequency channel arrangements based on a homogeneous pattern for radio-relay systems operating in the 4 GHz band".
- [6] ITU-R Recommendation F.1099-3: "Radio-frequency channel arrangements for high-capacity digital radio-relay systems in the 5 GHz (4 400 - 5 000 MHz) band".
- [7] CEPT/ERC/REC 14-02: "Radio-frequency channel arrangements for medium and high capacity analogue or high capacity digital radio-relay systems operating in the band 6 425 MHz - 7 125 MHz".  
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- [8] ITU-R Recommendation F.384-7: "Radio-frequency channel arrangements for medium and high capacity analogue or digital radio-relay systems operating in the upper 6 GHz band".
- [9] CEPT/ERC/REC 12-06: "Harmonised radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10,7 GHz to 11,7 GHz".
- [10] ITU-R Recommendation F.387-9: "Radio-frequency channel arrangements for radio-relay systems operating in the 11 GHz band".
- [11] ITU-T Recommendation G.826 (1999): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".
- [12] ITU-R Recommendation F.1397: "Error performance objectives for real digital radio links used in the international portion of a 27 500 km hypothetical reference path at or above the primary rate".
- [13] ITU-R Recommendation F.1491: "Error performance objectives for real digital radio links used in the national portion of a 27 500 km hypothetical reference path at or above the primary rate".
- [14] ITU-R Recommendation F.752-1: "Diversity techniques for radio-relay systems".
- [15] ITU-R Recommendation F.1093-1: "Effects of multipath propagation on the design and operation of line-of-sight digital radio-relay systems".
- [16] ITU-R Recommendation F.1101: "Characteristics of digital fixed wireless systems below about 17 GHz".
- [17] ETSI EN 300 019 (all parts): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

- [18] ETSI ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources".
- [19] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".
- [20] ETSI EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".
- [21] ETSI EN 300 417-7-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 7-1: Equipment management and auxiliary layer functions".
- [22] ETSI EN 301 167: "Transmission and Multiplexing (TM); Management of Synchronous Digital Hierarchy (SDH) transmission equipment; Fault management and performance monitoring; Functional description".
- [23] ITU-T Recommendation G.783 (2000): "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".
- [24] ITU-T Recommendation G.784 (1999): "Synchronous digital hierarchy (SDH) management".
- [25] IEC 60154 (all parts): "Flanges for waveguides".
- [26] ETSI ETS 300 635: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of M x STM-N".
- [27] ITU-R Recommendation F.750-4: "Architectures and functional aspects of radio-relay systems for synchronous digital hierarchy (SDH)-based network".
- [28] ETSI TR 101 035: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) aspects regarding Digital Radio Relay Systems (DRRS)".
- [29] ITU-T Recommendation O.151 (1992): "Error performance measuring equipment operating at the primary rate and above".  
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- [30] ITU-T Recommendation O.181 (2002): "Equipment to assess error performance on STM-N interfaces".
- [31] CEPT/ERC/REC 74-01: "Spurious emissions".
- [32] ITU-R Recommendation SM.329-9: "Spurious emissions".
- [33] ITU-R Recommendation F.1191-2: "Bandwidths and unwanted emissions of digital fixed service systems".
- [34] ETSI EN 300 833: "Fixed Radio Systems; Point-to-point Antennas; Antennas for point-to-point fixed radio systems operating in the frequency band 3 GHz to 60 GHz".
- [35] ETSI TR 101 036-1: "Fixed Radio Systems; Point-to-point equipment; Generic wordings for standards on digital radio systems characteristics; Part 1: General aspects and point-to-point equipment parameters".
- [36] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [37] ETSI EN 301 489-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services".
- [38] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

- [39] ITU-T Recommendation G.828: "Error performance parameters and objectives for international, constant bit rate synchronous digital paths".
- [40] ITU-T Recommendation G.829: "Error performance events for SDH Multiplex and regenerator sections".
- [41] ITU-R Recommendation F.1492: "Availability objectives for real digital radio-relay links forming part of international portion constant bit rate digital path at or above the primary rate".
- [42] ITU-R Recommendation F.1493: "Availability objectives for real digital radio-relay links forming part of national portion constant bit rate digital path at or above the primary rate".
- [43] ITU-R Recommendation F.1102-1: "Characteristics of fixed wireless systems operating in frequency bands above about 17 GHz".
- [44] ITU-R Recommendation P.530-10: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".
- [45] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".
- [46] ETSI ETS 300 019-1-3: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".
- [47] ETSI ETS 300 019-1-4: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".

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## 3 Symbols and abbreviations

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### 3.1 Symbols

For the purposes of the present document, the following symbols apply:

dB	deciBel
dBm	deciBel relative to 1 mW
GHz	GigaHertz
Hz	Hertz
kHz	kiloHertz
km	kilometre
Mbit/s	Megabits per second
MHz	MegaHertz
ns	nanosecond
ppm	part per million

### 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACCP	Adjacent Channel Co-Polar
ATPC	Automatic Transmit Power Control
BBER	Background Block Error Rate
BER	Bit Error Rate
CCDP	Co-Channel Dual Polar
CMI	Coded Marked Inverted
CSmin	minimum practical Channel Separation (for a given radio-frequency channel arrangement)
CW	Continuous Wave
DC	Direct Current
EMC	Electro Magnetic Compatibility

Fc	cut-off Frequency
IF	Intermediate Frequency
IPI	Inter Port Isolation
LO	Local Oscillator
NFD	Net Filter Discrimination
PDH	Plesiochronous Digital Hierarchy
PRBS	Pseudo Random Bit Sequence
QAM	Quadrature Amplitude Modulation
RCSOH	Radio Complementary Section OverHead
RF	Radio Frequency
RL	Return Loss
RSL	Receive Signal Level
RX	Receiver
S/I	Signal to Interference ratio
SOH	Section OverHead
S/XPI	Signal to Cross Polar Interference ratio
SDH	Synchronous Digital Hierarchy
STM	Synchronous Transfer Module
TMN	Telecommunications Management Network
TX	Transmitter
XPD	Cross Polar Discrimination
XPI	Cross Polar Interference
XPIC	Cross Polar Interference Canceller

---

## 4 General Characteristics

### 4.1 Frequency bands and channel arrangements

The equipment shall operate on one or more of the channels as defined below.

#### 4 GHz

The frequency range is 3,6 GHz to 4,2 GHz. The channel plan shall be in accordance with CEPT/ERC/REC 12-08 [4], annex A, Part 1 or ITU-R Recommendation F.635-6 [5], with 40 MHz channel spacing. The centre gap is 80 MHz.

#### 5 GHz

The frequency range is 4,4 GHz to 5 GHz. The channel plan shall be in accordance with ITU-R Recommendation F.1099-3 [6] with 40 MHz channel spacing. The centre gap is 60 MHz.

#### U6 GHz

The frequency range is 6 425 GHz to 7 110 GHz. The channel plan shall be in accordance with CEPT/ERC/REC 14-02 [7] or ITU-R Recommendation F.384-7 [8] with 40 MHz channel spacing. The centre gap is 60 MHz.

#### 11 GHz

The frequency range is 10,7 GHz to 11,7 GHz. The channel plan shall be in accordance with CEPT/ERC/REC 12-06 [9] or ITU-R Recommendation F.387-9 [10] with 40 MHz channel spacing. The centre gap is 130 MHz, 90 MHz or 50 MHz according to the frequency arrangement.

NOTE: With a frequency arrangement providing a central gap of 50 MHz, common TX/RX operation of the nearest channels is not required.